

STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION  
ADMINISTRATIVE SERVICE CENTER  
OFFICE OF PROCUREMENT AND CONTRACTS  
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SPECIFICATIONS FOR GLASS SPHERES (BEADS)

**1.0 SCOPE**

- 1.1** Type I is not coated and Type II is coated to provide moisture proofing for high humidity conditions, where sphere flow may be impaired.

**2.0 SPECIFICATIONS AND STANDARDS**

- 2.1** Specifications and standards referenced in this document in effect on the opening of the Invitation for Bid form a part of this specification where referenced.

**3.0 REQUIREMENTS**

- 3.1** Glass spheres Type I and Type II shall meet the following requirements.

- 3.1.1 General** Glass spheres shall lend themselves readily to firm embedment in the traffic paint when dropped on a freshly placed paint line. The embedment shall be of such character as to provide a highly reflectorized surface on the paint with reserve reflectorizing capacity in the lower sections of the paint film. The reflection shall be effectively manifest to the operator of a motor vehicle when the headlights of the vehicle are shown on the marking.

- 3.1.2 Appearance** A minimum of 85% of the beads by count shall be colorless, true spheres, free of dark spots, milkiness, air inclusions and surface scratches when viewed under 20X magnification. The beads shall be clean and free from foreign matter in accordance with high grade commercial practice.

>Indicates Revisions (Excluding Spec. No. & Date)

**3.1.3 Gradation** The glass spheres shall conform to the following grading requirements:

<u>Sieve Size</u>	<u>% By Weight Passing</u>
600 µm	100
250 µm	40 - 70
180 µm	15 - 35
106 µm	0 - 5

**3.1.4 Physical Properties** Glass spheres shall conform to the following properties:

Refractive Index, minimum	1.50
Specific Gravity	2.40 to 2.60
Moisture Content, maximum	0.01%

**3.1.5 Chemical Stability** Refluxing a sample of beads for 8 hours with distilled water shall not produce more than a very slight reduction in luster or reflecting power of the beads.

**3.1.6 Flow** Beads shall be free flowing. A 23kg sample of beads, emptied into a service box screen, Sieve Size 1.18mm shall pass completely through the screen without shaking or any excessive hand manipulation.

**3.2 Type II (Moisture Proof):** The Type II beads shall conform to all the requirements for Type I beads and the following requirement for moisture resistance.

**3.2.1 Moisture Resistance Test (Flow)** Moisture resistance of the beads shall be determined by the following procedure.

1. Use a pre-washed 267mm x 444mm unbleached cotton sheeting bag having a 48 x 48 thread count.
2. Turn the bag inside out to prevent water plus beads from being entrapped within the seams.
3. Place 907g of beads in the cotton bag.
4. Immerse the bag containing the sample in a bucket of water at room temperature (21-22<sup>0</sup>C) for 30 seconds, or until the water covers the beads (whichever is longer).
5. Remove the bag and sample from water and squeeze the excess water out of the bag by twisting the neck of the bag.
6. Allow the bag to be suspended for 2 hours at room temperature. Do not allow the neck to loosen.

7. Mix the sample thoroughly by releasing the tension in the neck and shaking the bag, thus loosening the beads from bottom and sides.
8. Transfer the sample to the clean dry funnel (150mm top diameter, 120 mm deep, 6.35mm ID stem).
9. If the beads bridge in the funnel while pouring the sample in, the funnel can be tapped lightly at the beginning to start the flow but not after flow has once started.
10. After flow stops, the funnel must be essentially empty of glass spheres.

#### **4.0 QUALITY ASSURANCE PROVISIONS**

**4.1 Inspection:** The material shall be inspected and tested as specified in the Invitation for Bid.

**4.2 Testing:**

**4.2.1 Index of Refraction** The beads shall show a minimum index of refraction of 1.5 by the oil immersion method using a tungsten light, per ASTM Special Publication 500 Paragraph 1.3.2.1.

**4.2.2 Specific Gravity** The beads shall have a specific gravity from 2.40 to 2.60 at 25<sup>0</sup>C, per ASTM D-153 Method A.

**4.2.3 Moisture Content** Moisture content, as determined by weight lost of 25g of beads in an oven at 105<sup>0</sup>C for 3 hours, shall not exceed 0.01 %.

**4.2.4 Chemical Stability** Refluxing of a 50 g sample of beads in a Soxhlet extraction apparatus for 8 hours with distilled water shall not produce more than a very slight reduction in luster or reflecting power of the beads.

#### **5.0 PREPARATION FOR DELIVERY**

**5.1 Packaging:**

- (1) **Bags:** Glass spheres shall be packaged in pinch bottom style paper bags having glued top and bottom seams. Bags shall comply with the requirements of Federal Specification UU-S-48, Type VI, Style B, MB-3, Sack 13.

Each bag shall contain 11 kg of glass spheres and shall be plainly and conspicuously marked or branded on the side with the net weight of the glass spheres.

- (2) **Fiber Drums:** Drums shall conform to the Uniform National Freight Classification, Item 21840, Rule No. 291. These shall be designed for 249 kg of beads with 508mm inside diameter and 825.5mm inside height. Must pass 454kg side wall test. Top cover shall be of steel with lock-rim. A polyethylene liner to be placed in the drum before filling. Four drums to be placed on a 1.1m x 1.1m pallet. Shrink wrap to be placed around the four drums.
- (3) **Totes:** Shall meet the requirements of Agency Specification 8010-005.

Packaging shall conform to the applicable rules and sections of the current National Motor Freight Classification in use at the time of delivery. Deviation from packaging requirements shall require written consent of Department of Transportation, Office of Procurement and Contracts.

**5.2 Marking:** Type I, beads shall be marked with a wide blue diagonal stripe on the outside of the bag.

**5.3 Shipping:**

**5.3.1 Pallets:** Bags shall be palletized on pallets furnished by the vendor. The pallets shall become the property of the State of California. The pallets shall meet all the requirements of State Specification 3990-XXX-01, Type II, Size 2. The size shall be 1.1m by 1.1m.

The outside of one stringer shall be stenciled, "Return to Department of Transportation Warehouse".

**5.3.2 Palletizing:** 48 bags per pallet. The loaded pallets shall be plastic shrink wrapped.